

**CICHLID FISHES FROM THE LA PLATA BASIN.
PART VI. DESCRIPTION OF A NEW *BUJURQUINA* SPECIES
FROM BOLIVIA**

by

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ABSTRACT. - *Bujurquina oenolaemus* n. sp. is described from the Rio Aguas Calientes in the upper Rio Paraguay drainage basin. It is distinguished by long head and snout, and molarized pharyngeal teeth, and may be a specialized molluscivore.

RESUME. - *Bujurquina oenolaemus* n.sp. est décrit d'après neuf spécimens provenant de la rivière Aguas Calientes dans la partie bolivienne du bassin du Paraguay. La nouvelle espèce se distingue par sa tête et son museau très longs, et sa dentition pharyngienne molarisée. Il est probable que *B. oenolaemus* est malacophage spécialisé.

Keywords : Aguas Calientes, Bolivia, *Bujurquina*, *Bujurquina oenolaemus*, Cichlidae, Molluscivory, Paraguay river drainage, Warm springs.

Many of the 19 known cichlid species in the Paraguay River drainage are local endemics, but the majority of them nevertheless belong to genera widely distributed in more northern drainage basins. The new species described below from a single locality in southeastern Bolivia, belongs to a species-rich genus, *Bujurquina* Kullander (1986), which comprises over 20 species of which all except two have their geographical ranges in drainage systems north of the La Plata basin.

Bujurquina species have long been considered as members of the genus *Aequidens* Eigenmann & Bray. Distinguishing characters include uniserial instead of triserial predorsal midline scale pattern, a dorsal furrow for the hyoid artery, accessory lateral line between caudal-fin rays D1 and D2 instead of between rays D3 and D4, and a dark band running obliquely forwards across the nape. See Kullander (1986) for a detailed description and comparison with similar groups.

Of the two *Bujurquina* species in the Paraguay basin, one is described below, and is of special interest for being, apparently, a specialized molluscivore. The other species is *B. vittata* (Heckel), which has a wide distribution throughout the Paraguay basin and adjacent parts of the Parana. That species will be treated in a subsequent paper in this series on La Plata basin cichlids. Earlier parts in this series have dealt with miscellaneous species (Kullander, 1981), *Apistogramma* Regan (Kullander, 1982a, 1983a), *Crenicichla* Heckel (Kullander, 1982b) and *Aequidens* (Kullander, 1984). Species of *Cichlasoma* Swainson were treated in a separate paper (Kullander, 1983b).

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METHODS

Measurements were taken with dial callipers reading to 0.05 mm, rounded to nearest 0.1 mm. Counts were obtained under a binocular dissecting microscope. Procedures for recording both quantitative and qualitative data are described in some detail in Kullander (1979, 1980a, 1980b, 1983b, 1986). The description below follows the scheme used by Kullander (1986) for other species of *Bujurquina*.

Abbreviations used include SL (standard length), squ. long. (scales in a lateral series), D (dorsal-fin count) and A (anal-fin count). Caudal-fin rays are numbered V1-V8 in the ventral lobe and D1-D8 in the dorsal lobe, whereby counting starts on either side of the hypural gap, proceeding toward procurent rays. Vertical bars are numbered from the caudalmost, on the caudal peduncle (Bar 1), in cephalad succession (to Bar 7). Counts of upper and lower lateral line scales and upper and lower jaw teeth are separated by a slash. Frequencies appear in parentheses after each count; a dash (-) indicates that no count was possible.

The material studied is deposited in the ISNB (Institut royal des Sciences naturelles de Belgique, Bruxelles) and NRM (Swedish Museum of Natural History, Stockholm).

RESULTS

Bujurquina oenolaemus sp. n.

(Fig. 1-6, Table I)

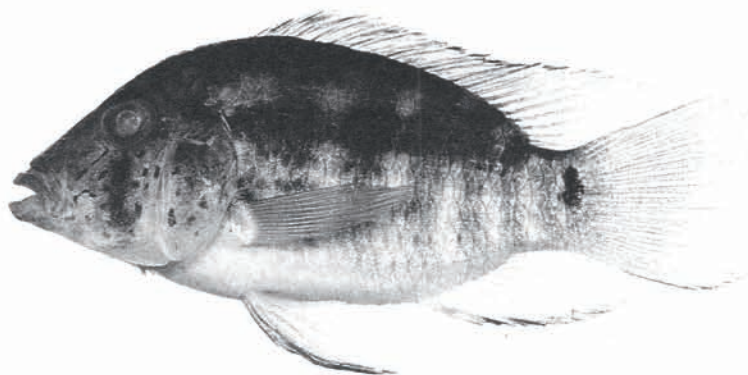


Fig. 1 : Holotype of *Bujurquina oenolaemus*, a female, 58.1 mm SL, ISNB 666.

Holotype: ISNB 666. 58.1 mm SL. Bolivie, dép. Santa Cruz. Rio Aguas Calientes à Aguas Calientes, à 25 km à l'est de Roboré, sur le rail. (Bassin du Paraguay.) 22 octobre 1977. Leg. J.P. Gosse (Expédition Fonds Léopold III. Chaco II 1977. Sta. 22).

Paratypes: ISNB 667 (7) and NRM A86/1977426.3842 (1). Eight specimens, 31.4, 44.5, 44.6, 47.6, 48.3, 52.7, 60.8, and 67.2 mm SL. Same data as the holotype.

Diagnosis: Squ. long. 21-23; jaws equal anteriorly; lips narrow; pectoral fin short, 29.0-32.2 % of SL; lateral band continuous, running toward soft dorsal-fin base; Bars 5 and 6 continuous; intense curved suborbital stripe, retained in adults; no distinct nape band; Bar 7 blotch-like; posterior dorsal fin otherwise immaculate. Distinguished from all other *Bujurquina* species by molarized lower pharyngeal teeth, long head (length 38.6-40.4 % of SL), long snout (length 9.6-13.1 % of SL), enlarged anterior vertebrae, hypertrophied pharyngeal musculature, and in lacking a prominent dark band across the nape.

Description : Body moderately deep (depth 38.9-43.6 % of SL in paratypes; holotype exceptional with 47.2 %), deepest at insertion of pelvic fins. Head long, with broad nape. Frontal profile straight to above about anterior margin of orbit, gently curved above; ventral head contour about straight, less steep. Snout slightly produced, with straight contours, dorsal steeper than ventral. Mouth slightly broader than interorbital space. Maxilla not reaching posteriorly to a vertical from anterior edge of orbit. Premaxillary ascending processes reaching about to anterior margin of orbit. Jaws equal. Lip folds narrow. Interorbital area almost flat, laterally slightly convex, medially slightly concave. Paratypes have 5 branchiostegal rays on each side; holotype abnormal on right side with rays replaced by a plate supported by ribs of bone or strong cartilage running transversely to normal ray direction. No apparent external sex dimorphism in the material examined; the 67.2 mm specimen is a female with immature ova.

Scales large, ctenoid on sides; squ. long. 21 (1), 22 (6), 23 (2). Predorsal scales large, of about size of anterior flank scales, weakly ctenoid or cycloid, in three usually irregular series posteriorwards from between the orbits. Figure 2 shows a very regular pattern of predorsal scales, with 8 scales in a middle series, but 1-2 medial posterior scales may be replaced by bilateral overlapping scales; 7-8 scales in bordering series to dorsal-fin origin. Lateral chest scales mostly ctenoid, slightly smaller than anterior flank scales. Pectoral fin and most of pectoral axilla naked; small cycloid scales basally on external portion of pectoral axilla. Prepelvic scales cycloid, slightly smaller than anterior flank scales, and arranged in a middle series of 9-10 scales margined by a series from each pelvic-fin spine base forwards.



Fig. 2 : Dorsal aspect of predorsal squamation in *Bujurquina oenolaemus*, 47.6 mm SL. ISNB 667; scale outlines dotted.

Head scales cycloid and large, largest about size of anterior flank scales, but anterior cheek scales distinctly smaller. Cheek scales forming 3 oblique series in all specimens. Anteriorly, adjacent to mouth angle, a naked area corresponding to about one scale in width. Opercular scales in 2 oblique vertical series; a patch of smaller scales covering dorsal edge. Sub- (3-4) and inter-opercular (2-3) scales in single series. Preoperculum naked.

Scale pattern somewhat irregular at beginning of upper lateral line, which usually is contained in 3rd horizontal series above that containing lower lateral line, but occasionally beginning in 2nd to shift to 3rd after 3 scales; distance to dorsal fin 3 scales at beginning, 2 at middle, and 1 1/2 at end (below 2nd dorsal-fin ray); 2 scales overlapping with lower lateral line. Lateral line counts: 15/pore + 6 (1), 15/7 (6), 16/7 (2). Lower lateral line continued on caudal-fin base by 1-2 tube-bearing scales in all specimens; short series of tubed scales slightly posterior to base between rays D1 and D2 (none in 3, 1-2 scales in 6 specimens) and between rays V4 and V5 (none in 3, 1-5 scales in 6 specimens). Dorsal and anal fins naked. Caudal fin scaly proximally, for 1/4-1/2 its length; basally a layer of 3-4 ctenoid scales continuing body squamation but smaller than adjacent body scales, distally a few weakly ctenoid small scales contained between rays, in a single series on each membrane. Some scales between first dorsal and ventral rays have a distal concavity.

Dorsal fin origin above origin of upper lateral line, in advance of a vertical from distal edge of operculum; spines subequal in length from 5th, last 2 successively longer; anterior lappets rounded, posterior truncate with a posterior pointed tip. Soft dorsal fin pointed, 4th ray longest, reaching nearly to middle of caudal fin; in two smallest specimens more rounded and reaching only to slightly behind caudal fin base. Anal fin origin at about middle of posterior half of body; soft part pointed, 3rd ray longest, reaching to nearly middle of caudal fin. D. XIII.9 (4), XIII.10 (2), XIV.8 (1), XIV. 9 (1, holotype), either XIII.9 or XIV.8 (1). A. III.7 (7, including holotype), III.8 (2).

Pectoral fin rays 12 (holotype) or 13 (paratypes), 4th ray longest, reaching posteriorly to a vertical from genital papilla or 2nd anal fin spine; lowermost and 2 uppermost rays simple, remainder bifid. Pelvic fin inserted below caudal edge of pectoral axilla; pointed, major portion reaching to genital papilla, first ray forming a tip and reaching to 1st to 3rd anal fin spine. Caudal fin subtruncate: corners rounded, medial edge straight or slightly concave; 2 marginal rays in each lobe simple, remainder with 2-4 branches; 16 principal caudal fin rays in all specimens except in holotype which has 9 dorsal and 8 ventral rays.

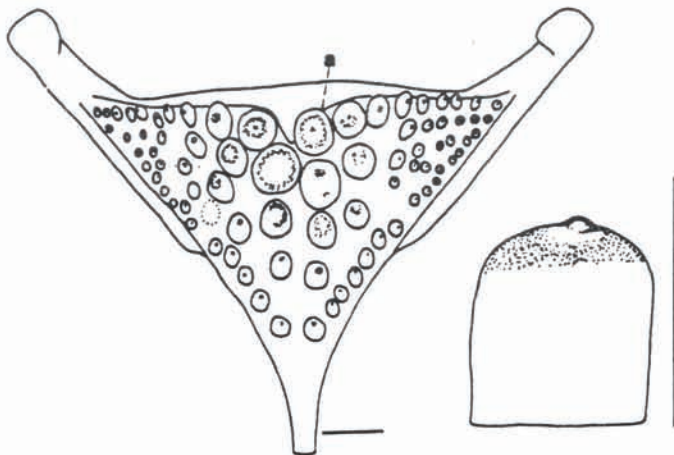


Fig. 3 : Occlusal view of lower pharyngeal tooth-plate and lateral aspect of posterior tooth (a) in *Bujurquina oenolaemus*, 67.2 mm SL, NRM A 86/1977426.3842. Scales 1 mm.

External gill-rakers on first ceratobranchial 6(8) or 7 (1). Microgill-rakers absent.

Lower pharyngeal tooth-plate in 67.2 mm paratype (Fig. 3) with few but strong teeth. Anterior teeth subconical, with near circular bases; those nearer posterior corners with laterally compressed bases, an anterior shelf or knee more or less developed, a posterior cusp long and antrorse; towards middle much enlarged, short molariform teeth with broad, rounded apical surface, those near middle in posteriormost series rather mammiform, with slight central nodule. Fourth ceratobranchial with 2 toothplates with 2 and 3 teeth, respectively.

Jaw teeth caniniform, with slightly recurved tips, those of outer series stronger than those of inner series; 16-21/18-23 teeth in outer hemiseries of upper/lower jaw, 3-4 inner series symphysially, one slightly extended in upper jaw.

Vertebrae 12+11 (1; 11 preanal), 12+12 (7; 11 (4) or 12 (3) preanal); 4 anterior vertebrae distinctly larger than posterior; 2-3 vertebrae within caudal peduncle.

Table I. Morphometry of *Bujurquina oenolaemus*. Measurements, except SL (in mm), expressed as per cent of SL.

	n	Range	$\bar{x} \pm s$ ($\bar{x}$)
SL (mm)	9	31.4-67.2	
Head length	9	38.6-40.4	39.2 $\pm$ 0.18
Snout length	9	9.6-13.1	11.4 $\pm$ 0.36
Body depth	9	38.9-47.2	42.2 $\pm$ 0.76
Orbital diameter	9	11.8-14.6	12.7 $\pm$ 0.27
Head width	9	18.8-20.8	19.5 $\pm$ 0.19
Interorbital width	9	8.9-12.1	10.5 $\pm$ 0.32
Preorbital depth	9	6.4-10.7	9.2 $\pm$ 0.42
Caudal peduncle depth	9	15.3-18.9	16.9 $\pm$ 0.34
Caudal peduncle length	9	10.1-13.0	11.4 $\pm$ 0.31
Pectoral fin length	7	29.0-32.2	30.8 $\pm$ 0.47
Pelvic fin length	9	29.0-34.0	32.0 $\pm$ 0.55
Last dorsal-fin spine length	8	15.5-17.0	16.3 $\pm$ 0.17

Colouration (chiefly from the holotype): Ground colour yellowish white, pure on chest and abdomen, sides smoky; countershaded, back brown, gradually paler adventrally. Lips greyish; lower jaw anteriorly greyish, posteriorly paler, like transparent inter-, sub-, and most of preoperculum. Operculum brownish. Cheek and adjacent parts of preoperculum yellowish overlaid with brown. Greyish to brownish grey on snout and most of preorbital. Nape and forehead brownish. No distinct band across nape, though indicated above eye in some specimens. No distinct dark or light edging of scales. A broad brown suborbital stripe, of pupil width, running from just below orbit, slightly curved and with indistinct edges, to anterior corner pore of preoperculum. Small brown dots and short lines irregularly scattered over cheek, operculum, upper edge of suboperculum, interoperculum and adabuccal part of preorbital. A brown, horizontally oval, indistinctly delimited spot over upper edge of operculum, not reaching to orbit and narrowly separated from lateral band on side. Branchiostegal membrane of rosé wine colour.

Lateral band brown, with uneven edges, of about one scale width, running from below origin of lateral line to second vertical bar (Bar 3) behind midlateral spot; terminally dorsad curved by the identically pigmented dorsal portion of the two vertical bars (Bars 3 and 4) behind that containing the midlateral spot. A pale zone borders above, on and along upper lateral line backwards to midlateral spot; above

this zone vertical bars confluent, forming brown area extending well anterior to dorsal fin origin. Midlateral spot a roundish, blackish-brown blotch, about two scales deep, below lateral line scales 8-10; contained in a paler brown vertical bar (Bar 5) which is indicated above to dorsal fin base, more distinct below, to a line between pectoral axilla and anal fin origin. Bar 6 expressed as a diffuse dark field below anterior portion of lateral line; posterior to it two vertical bars above anal fin (Bars 3-4), one between dorsal and anal fin ends (Bar 2), and one across terminal portion of caudal peduncle (Bar 1).

Dorsal fin light grey, semitransparent. Lappets, except anteriormost ones, white distally, basally darkened, dark bases more intense posteriorly, where also subbasal light spot forms (Fig. 4). Soft dorsal fin almost hyaline, with a few hyaline spots indicated. Anal fin smoky, with a broad blackish lower margin. Caudal fin smoky, with narrow dark lower margin and indicated hyaline spots; a brown, narrow-oval unocellated spot on base from lower lateral line upwards, but not reaching to dorsal edge of fin. Pelvic fin hyaline, outwardly smoky, outer edge blackish.



Fig. 4 : Pigmentation of dorsal fin in *Bujurquina oenolaemus*, illustrated section from posterior spinous portion in 52.7 mm paratype, ISNB 667. Semidiagrammatic.

In all paratypes there is a pale zone bordering the anterior section of the lateral band dorsally; above it generally dark, but three dark fields can be distinguished, one around and before dorsal fin origin, one above midlateral spot, and one between these. Lateral band usually continuous with postorbital spot. Buccal dots vary in number and position, missing in smallest specimen; occasionally also a spot on exposed tip of maxilla. In 1982, when this description was first drafted, reddish pigment was present on the branchiostegal membrane in all specimens, though macroscopically the reddening was considerably fainter than in holotype; on revision in 1986, the red colour was virtually gone from all specimens. Caudal base spot roundish or squarish. The smallest specimen has no marginal dorsal fin pattern, only slightly darkened anal-fin edge, and white pelvic fin. The others have variously strong fin markings but all feature distinct white or hyaline spots on soft dorsal fin and weaker spots on inner half of caudal fin.

Etymology : The species epithet, a noun in apposition, is from the Greek *oinos*, wine, and *laimos*, throat, i.e. wine-throat, suggested by the wine-coloured branchiostegal membrane.

Distribution (Fig. 5) : *Bujurquina oenolaemus* is known only from the type locality, in the northwestern Paraguay River drainage.

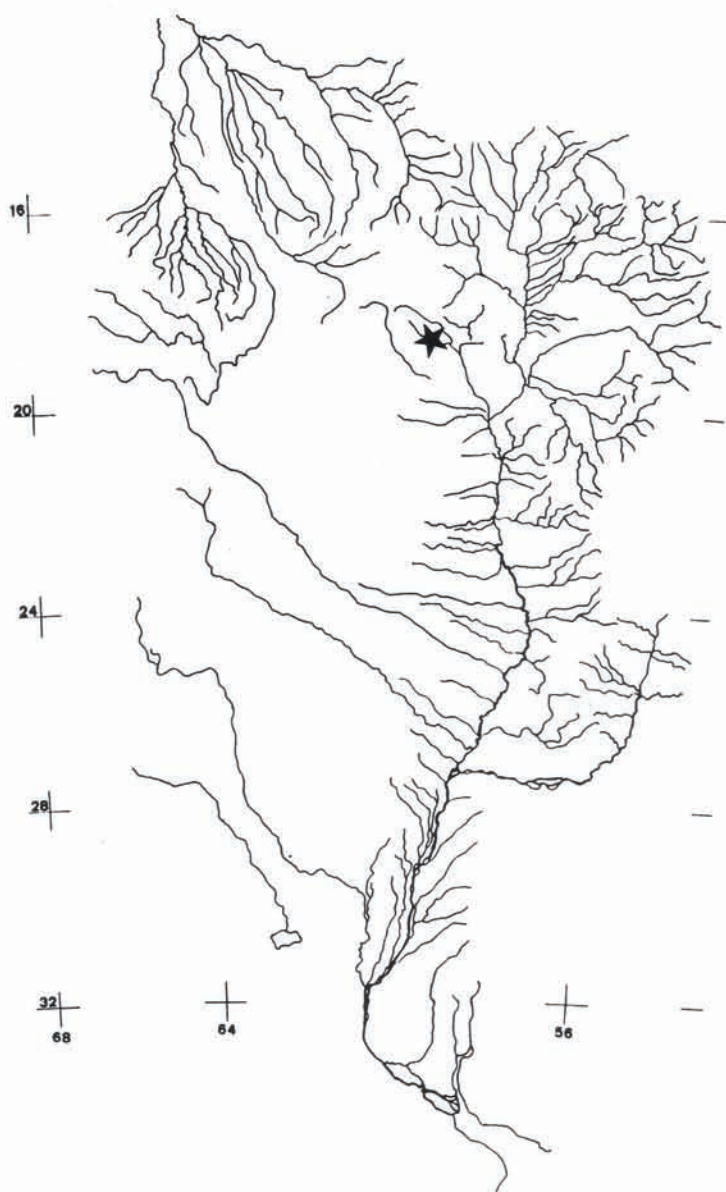


Fig. 5 : The Río de la Plata basin with collecting locality of *Bujurquina oenolaemus* indicated by a star.

Ecology : The collector, J-P Gosse, provided the following field notes on the type locality: "The small stream Aguas Calientes, at the railroad station Aguas Calientes, 25 km E Roboré, flows eastwards south of the railroad and expands into a laguna. Downstream of the laguna is located a pump station which furnishes water to the village and the railway station. Close to the pump station the laguna is used for bathing by the inhabitants of Roboré. Upstream from the laguna, the water springs from the sandy bottom, and the water temperature here is 41°C. The stream was 10-

15 m wide, 30-50 cm deep, with a bottom of fine white sand". No other cichlids were collected at this locality.

Four of the *B. oenolaemus* specimens have one to three specimens of *Poecilia hasemani* (Henn) (family Poeciliidae) in the oral cavity, but these most likely got there accidentally. During immediate post-capture procedures in the field small fishes commonly enter the mouths of larger fishes in the same can (pers. obs.), and no conclusions about actual prey-predator relationships can be drawn from the finding of small specimens in the mouths of bigger fish. The mouth shape and pharyngeal dentition of *B. oenolaemus* do not indicate principally ichthyophagous habits; rather the latter suggest a specialized molluscivore. Radiographs of the eight larger specimens show that four of them have small gastropod shells in the intestines. The shells appear to be intact, although I would have expected, from the pharyngeal dentition, that they would be crushed. The stomach of the only dissected specimen (67.2 mm) is filled with sand particles, but contains also ribs and vertebrae of some small non-cichlid fish, and a few fragments of mollusc shell; the intestine contains a gastropod specimen with almost undamaged shell.

DISCUSSION

Diagnosis: The diagnosis given above indicates characters distinguishing *B. oenolaemus* from all other *Bujurquina* species. Thirteen of these species were described by Kullander (1986), descriptions of others are in preparation. *Bujurquina oenolaemus* is highly distinctive in most aspects of its morphology, and is also the first South American cichlid recognized tentatively as a specialized molluscivore.

The presumed molluscivorous habits of *B. oenolaemus* are expressed morphologically by the large head, molarized pharyngeal dentition, hypertrophied pharyngeal muscles, and enlarged anterior vertebrae. Those features suggest a powerful crushing mechanism, the large head providing space for muscles, pharyngeal teeth acting as millstones, and the enlarged vertebrae providing anchorage for the retractor dorsalis muscle.

Other *Bujurquina* species so far studied have laterally compressed pharyngeal teeth with well-developed anterior posterior cusp and another cusp or shelf on the anterior edge, similar to most South American cichlids. Head and snout shape is variable - recorded head length 31.2-37.0 % of SL, snout length 5.3-11.5 % of SL (Kullander, 1986).

Bujurquina oenolaemus has a relatively short pectoral fin, distinguishing it from all *Bujurquina* species except *B. eurhinus*, *B. robusta*, and *B. huallagae*. Figure 6 indicates that *Bujurquina* species separate in three groups with regard to pectoral-fin length: short, medium and long, although there is some overlap in ranges.

The meristics of *B. oenolaemus* average low, reflecting latitudinal variation observed in both *Cichlasoma* (Kullander, 1983b) and *Bujurquina* (Kullander, 1986 and unpubl.) The squ. long. count (mode 22) is lower than in any other *Bujurquina* species (modes 23-24; Kullander, 1986). Bolivian Amazonian and the other Paraguayan *Bujurquina* species, *B. vittata*, have modally 23 squ. long. scales, whereas Western Amazonian species have 24, with a single exception (23 in *B. megalospilus*). Also the lateral line count is low for the genus, modally 15/7 compared to 16/8-9 in the Amazonian group as a whole (Kullander, 1986).

The basal vertebral count in *Bujurquina* species is 26, with 13 abdominal and 13 caudal vertebrae; as in *B. oenolaemus*, the last abdominal vertebra frequently bears a hemal spine projecting between the first two interhemals. The vertebral

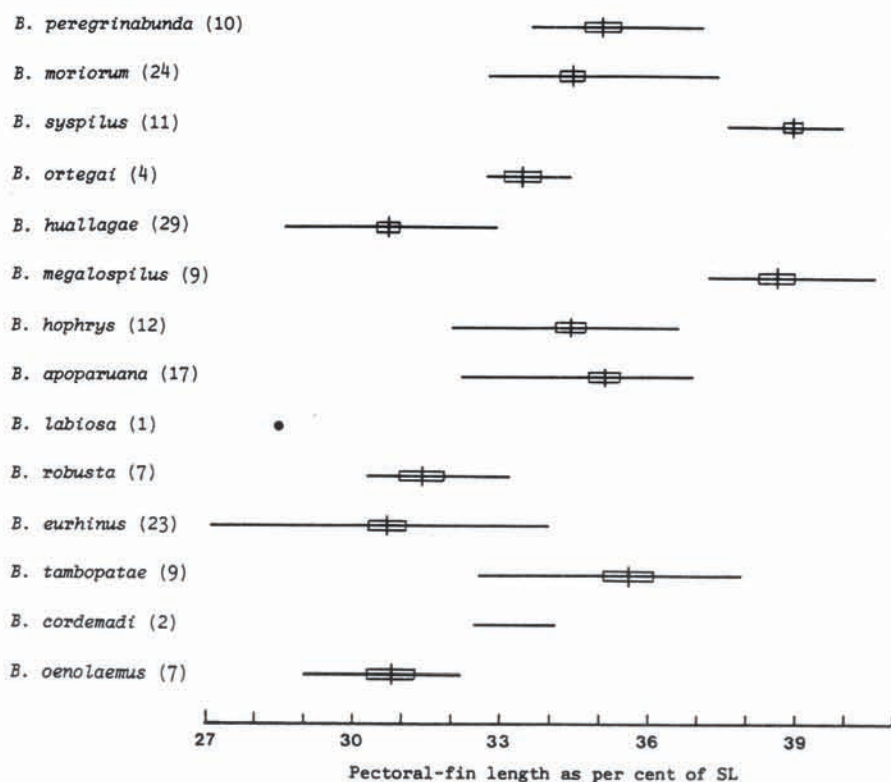


Fig. 6 : Comparison of pectoral-fin length in species of the genus *Bujurquina*. Number of specimens in parentheses; range horizontal line, mean vertical bar, 1SE indicated by square on each side of mean. Data from Kullander (1986) and present paper; not corrected for allometry.

count of *B. oenolaemus* (mode 24) averages lower than in any other *Bujurquina* species (modally 25 or 26) and reflects reduction by one abdominal and one caudal vertebra, compared to the common *Bujurquina* condition.

The dorsal-fin count is low, with modally 22 lepidotrichia and commonest count XIII.9. Amazonian species have modal counts XIV.10 or XIV. 9 (Kullander, 1986).

The reddish branchiostegal membrane is a unique feature of *B. oenolaemus*, but which can be observed only in relatively fresh material. Life colouration is known for a few *Bujurquina* species, none of which has pigmented branchiostegal membrane (cf. Kullander, 1986). The absent or only indicated nape band is extraordinary in the genus for which this marking was given as one of the diagnostic features. The pattern of dark pigment anteriorly on the side, involving a contrasting light zone bordering the lateral band and confluence of dorsal parts of vertical bars to form a uniformly dark back, represents a modification of the disposition in other *Bujurquina* species in which the light zone remains dusky and vertical bars remain separate. Other colour features of *B. oenolaemus* are shared with one or more other species in the genus.

The caudal fin of *Bujurquina* species is usually slightly emarginate, with prolonged marginal rays; *B. oenolaemus* departs in having a decidedly subtruncate caudal fin without indication of prolonged marginal rays.

There is no character by which *B. oenolaemus* can be shown to be more closely related to any particular other *Bujurquina* species. It agrees, however, with other Bolivian Amazon and Paraguayan species, and some Western Amazonian, in having the lateral band running to the soft dorsal-fin base instead of to the angle of caudal peduncle and dorsal fin base, and in retaining the suborbital stripe as adult.

Molluscivory: Molluscs, both bivalves and gastropods, are locally abundant in Amazonian white waters (pers. obs.) and should be expected to make up a significant part of the diet of some South American fishes. Goulding (1980) suggested, on the basis of stomach analyses, that the doradid catfish *Megalodoras irwini* might be a snail feeder, otherwise molluscs appear to be recorded only as incidental food in South American freshwater fishes.

Molluscs have been reported from stomachs of other South American cichlids, e.g. *Aequidens tetramerus* (Heckel) (Saul, 1975) and *Cichlasoma bimaculatum* (Linnaeus) (Lowe-McConnell, 1969). Neither of these species show morphological trophic specializations, and both seem to be rather omnivorous.

The only other South American cichlids having a pharyngeal dentition suggesting a capacity to crush mollusc shells, are species of *Gymnogeophagus* Ribeiro and *Geophagus* sensu lato (Gosse, 1976, pls. IV-V) and perhaps also *Tahuantinsuyoa macantatza* Kullander (1986) and members of the "*Acarichthys*" *geayi* group (unpubl. data). Radiographs of *Geophagus brasiliensis* (Quoy & Gaimard) and *Gymnogeophagus* cf. *australis* (Eigenmann) (cf. Kullander, 1981) show intestines crammed with mollusc shells.

Distribution: it appears that *B. oenolaemus* is geographically restricted as inferred from its singular occurrence in the rather extensive Paraguay system collections available. Collections from the Paraguay drainage basin are nevertheless restricted to easily accessible localities, and the species may be expected to occur in other places than the type locality.

Bujurquina oenolaemus is the only cichlid species so far recorded from Aguas Calientes. Travassos (1957; see also Travassos & Travassos, 1957) reported cichlids collected from a warm spring (38-41°C water temperature) at Aguas Calientes, possibly the type locality of *B. oenolaemus*, but did not give a species determination. Possibly, the apparent restricted distribution of *B. oenolaemus* relates to the warm springs. It is interesting to note, however, that the *B. oenolaemus* studied contain mouthfuls of *Poecilia hasemani*, a species previously known only from Puerto Suárez (Bolivian-Brazilian border, near Corumbá; Henn, 1916; Rosen & Bailey, 1963).

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